MATH S4062 SYLLABUS

More fun with epsilon

Welcome to MATH S4062, an awesome analysis adventure awaits you! This is the survival manual for this course, where you can find all the administrative info you need to know, such as office hours, grading, and other goodies. Feel free to e-mail me if you have any other questions.

Disclaimer: Any item on this syllabus is subject to change.

1. AT A GLANCE

Course Name	**MATH S4062 – Intro Modern Analysis 2**
Term	Summer 2022
Class times and location	MTWTh 10:45 am – 12:20 pm in 312 Math Building
Instructor Name	Peyam (π-m) Tabrizian
E-mail	pt2603@columbia.edu
Office	600 Math Building
Office Hours	MTWTh 12:30 – 1:15 pm Office hours will be held in person
TA	Taeseok Lee
TA E-mail	taeseok.lee@columbia.edu
TA Office Hour	TuF 2-5 pm in 406 Math Building

2. LOGISTICS

Course Description: (Credit 3) The official description includes: Equicontinuity. Contraction maps with applications to existence theorems in analysis. Lebesgue measure and integral. Fourier series and Fourier transform.

Prerequisites: Math 4061

Calculator Policy: Calculators are **NOT** allowed in the course; you won't really need to use them, you'll do everything with the power of your mind 😊

Learning Outcomes: In this course, we will delve deeper in the fascinating world of analysis by learning some further analytical tools, such as Fourier series, multivariable analysis, and measure theory. This course will be especially useful if you're planning

on going to math grad school. My hope is that you will finally learn to appreciate the importance and beauty of this powerful subject that mathematicians use in their real lives. We will cover the following chapters of the textbook:

- Sequences and Series of Functions (Chapter 7)
- Fourier Series (Chapter 8)
- Functions of Several Variables (Chapter 9)
- Measure Theory and Lebesgue Integral (Chapter 11)
- Differential Forms (Chapter 10, if time permits)

What this course is really about: I highly doubt that you'll forget the techniques you'll learn in this course because they are essential to human survival. That said, as Steve Krantz puts it in his book *How to teach Mathematics*, there is another goal of teaching this course. Namely, real purpose of this course is to teach you about mathematical discourse and critical thought. Just like in rhetoric, philosophy or politics, mathematics has its own language and way of thinking. How do mathematicians deal with an unknown problem? What methods do they use? What do they do when a given method doesn't work? Getting acquainted with all those different types of discourses is what your college education is really about.

Textbook:

- **Required**: *Principles of Mathematical Analysis (3rd edition)* by Walter Rudin, McGraw Hill, ISBN 978-0070542358. This is the main textbook of the course, and the homework problems will come from there. Although it's a great reference book if you already know the material, for beginners it's dry and difficult, hence I recommend looking at the recommended books below:

- **Recommended:** *Real Mathematical Analysis* by Charles Pugh, 2nd edition, Springer, ISBN 978-3319330426. This is the book I used when I learned analysis, and I owe much of my analysis knowledge from that book. It covers more or less the same material as Rudin, but it is fun to read and has very interesting problems and pictures. We will roughly follow Chapters 4, 5, 6 of this book.

- **Recommended:** (for Chapter 8) *Fourier Analysis: An Introduction* by Stein and Shakarchi, ISBN 978-0691113845. This is part of my favorite series (no pun intended) of analysis textbooks and gives an excellent introductory treatment of the subject, highly recommended. It has lots of amazing applications as well. We will roughly follow chapters 2 and 3 of this book.

- **Recommended:** (for Chapter 11) *Real Analysis: Measure Theory, Integration, and Hilbert Spaces* by Stein and Shakarchi, ISBN 978-0691113869. Same series as the book above, gives a very intuitive development of measure theory and integration. We will roughly follow the first two chapters of this book

Online resources you can use:

- Course website: This is the main course website, where you can find the lecture notes, occasional videos, homework, and study materials.

- Canvas: Here is where I'll post announcements and you can check your grades. You will also upload your homework assignments there

- Piazza: Here you can post questions and either your classmates or I can answer them.

- YouTube Channel: My YouTube channel, where you'll find useful videos related to this course.

- TikTok channel: I also have a TikTok channel with fun math-related videos, although I haven't posted on there in a while

3. GRADING (the part you've all been waiting for)

Grade Breakdown

Activity	Date	Percent
Homework	Usually on Tu and F	**35%**
Midterm	Tuesday, July 26	**25%**
Final Exam	Friday, August 12	**40%**
TOTAL		**100%**

Note: There is also an extra credit opportunity, see below

- **Grading Scale: (with +/- added)**

Range	*Grade*
[90,100]	A
[80,90)	B
[70,80)	C
[60,70)	D
[0,60)	F

Note: The scales below are a guarantee. For example, if you get 80, you are guaranteed at least a B- This is a difficult class, so it's certainly possible that I will curve the class at the end.

Exams: There will be one midterm and a final exam in this class. Bring your Columbia student ID and a pencil to all exams. **The exams will be held in the usual lecture room and the usual lecture time.**

Midterm: Tuesday, July 26
Final Exam: Friday, August 12

Note: Your final exam grade can replace your midterm grade if that is in your favor, so technically, the final exam could count up to 65% of your grade.

The exams are closed book, closed notes, and no calculators are allowed. They are cumulative

Graded Homework: Homework is due every Tuesday and Friday at 11:59 pm, except for the first day of class and exam days. You will find the homework assignments on my website and upload them on Canvas. **The homework will be challenging, but remember that it's also worth 35% of your grade.** It's very important to take homework seriously, because this is the key way to absorb the concepts in the course and to do well on the exams. On every homework, 2 or 3 problems will be thoroughly graded, and the rest will be graded on completeness, so make sure to attempt all the problems. NO late homework is accepted, except if you have a university-approved excuse. Your lowest homework assignment will be dropped.

Homework/Exam etiquette: Please write your answers in complete sentences. You are NOT allowed to use the symbol ∴ write 'therefore' instead. If your answer only involves math symbols and no English sentences at all, it won't get full credit. You are allowed to work on the homework with your classmates (but you don't have to), but the work has to be your own.

Extra Credit: You have an opportunity to earn 1% Extra Credit in this course. In order to do so, you have to be one of the top 10 posters on Piazza, so make sure to create posts and respond to your peer's posts regularly

WARNING: This is not an easy course, and you shouldn't take this too lightly. I will make you work very hard in this course. On the other hand, there will be many times where you'll feel overwhelmed and lost. Your feelings are completely **NORMAL**; I felt the exact same way when I took analysis. Think of it a workout; you can't build those math muscles without making them work. Please don't drop the ball; at the end, your hard work will be rewarded with infinite mathematical knowledge 😊 And please, please do not hesitate to ask for help, that is what I'm here for!

4. MISCELLANEOUS INFORMATION

Grade Appeals: If you believe an error has been made in grading, you have until the next class period after the exam is handed back to let me know. Otherwise, you must accept the grade you received.

Classroom Respect: Please refrain from using electronic devices during class, as doing so distracts not only you, but also those around you.

Note: As with any math class, it is *very* important that you keep up with the suggested homework and that you do not fall behind. Please do not hesitate to ask questions in class, to come to my office hours, or to send me an e-mail. I am here to help you enjoy and succeed in this course

Missing a test: Examinations will not be rescheduled because of travel arrangements or difference in time zones – it is your responsibility to schedule travel appropriately and be available on the test dates and times. Makeup exams will be given only under exceptional circumstances and you will need a doctor's note or other valid excuse.

Help room: https://www.math.columbia.edu/general-information/help-rooms/

Academic Integrity: Cheating and other forms of academic dishonesty **will not** be tolerated. Please do not compromise your integrity for the sake of temporary benefits. Any cheating during midterm or final will result in your failing the course and the matter being reported to your dean.

5. TENTATIVE SCHEDULE

Finally, sit back, relax, and enjoy the show 😊 On the next page, you can find a tentative schedule of the course. For a more accurate version, check out the one on the course website. This course will be extremely challenging, but I promise you that all your hard work will be worth it. I hope that you will fall in love with analysis as much as I did!

#		Date	Lecture
0	M	Jul 4	No class (Independence Day)
1	Tu	Jul 5	Lecture 1
2	W	Jul 6	Lecture 2
3	Th	Jul 7	Lecture 3
4	F	Jul 8	Lecture 4
	F	Jul 8	HW 1 due
5	M	Jul 11	Lecture 5
6	Tu	Jul 12	Lecture 6
	Tu	Jul 12	HW 2 due
7	W	Jul 13	Lecture 7
8	Th	Jul 14	Lecture 8
	F	Jul 15	HW 3 due
9	M	Jul 18	Lecture 9
10	Tu	Jul 19	Lecture 10
	Tu	Jul 19	HW 4 due
11	W	Jul 20	Lecture 11
12	Th	Jul 21	Lecture 12
	F	Jul 22	HW 5 due
13	M	Jul 25	Lecture 13
14	Tu	Jul 26	Midterm (covers Lectures 1 – 12)
15	W	Jul 27	Lecture 15
16	Th	Jul 28	Lecture 16
	F	Jul 29	HW 6 due
17	M	Aug 1	Lecture 17
18	Tu	Aug 2	Lecture 18
	Tu	Aug 2	HW 7 due
19	W	Aug 3	Lecture 19
20	Th	Aug 4	Lecture 20
	F	Aug 5	HW 8 due
21	M	Aug 8	Lecture 21
22	Tu	Aug 9	Lecture 22
	Tu	Aug 9	HW 9 due
23	W	Aug 10	Lecture 23
	Th	Aug 11	No class
24	F	Aug 12	Final exam (covers the entire course)